Small Business Innovation Research/Small Business Tech Transfer

Novel Methodology for the Rapid Acoustic Optimization of Supersonic Multi-Stream 3D Nozzles, Phase I

Completed Technology Project (2018 - 2019)

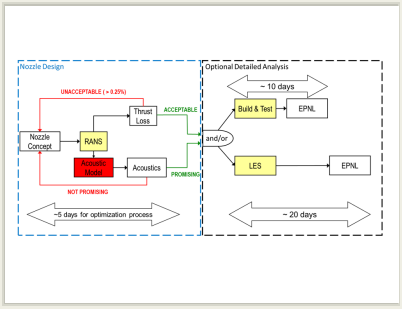
Project Introduction

Current noise prediction methods are ill-suited for the design of future nozzle geometries as they are either too computationally expensive or do not contain the necessary physics to adequately predict noise from desired nozzle types. As such, there is a need for innovative technologies and methods for noise prediction to enable acoustic optimization of multi-stream, 3D nozzle to meet the noise goals for NASA's N+2/N+3 aircraft. We propose to extend the Reynold Averaged Navier-Stokes (RANS) based models developed at University of California, Irvine, that have been shown to accurately predict noise for nozzles 3D, multi-stream nozzles. Our proposed method will allow for accurate and rapid prediction of acoustic emission on engineering workstation-class computers, enabling design engineers to perform acoustic optimization while preserving aerodynamic performance. Our competent team has over 60 years of combined experience in jet noise and has the expertise to ensure that an accurate RANS-based noise model is developed by the end of Phase II along with a working acoustic optimization tool that is usable by engineers and compatible with NASA's design framework.

Anticipated Benefits

The proposed design tool will be critical to the success of NASA's ARMD focus area of "innovation in commercial supersonic aircraft" and help meet the goals of N+2 and N+3. This technology is directly relevant to NASA's Advanced Air Vehicle Program. Incorporating our design methodology into NASA's toolbelt will allow for the development of advanced nozzles relevant to supersonic commercial aircraft that can meet the noise requirements of the International Civil Aviation Organization (ICAO).

Aircraft noise is also an issue for DoD aircraft. The Office of Naval Research has funded multiple projects under its Jet Noise Reduction (JNR) program to develop methodologies for noise reduction. Our proposed tool could certainly be of use to develop quieter DoD relevant nozzles that meet their desired mission criteria. In addition, the aerospace companies that will actually design and build future aircraft and engines will have a use for our proposed tool.



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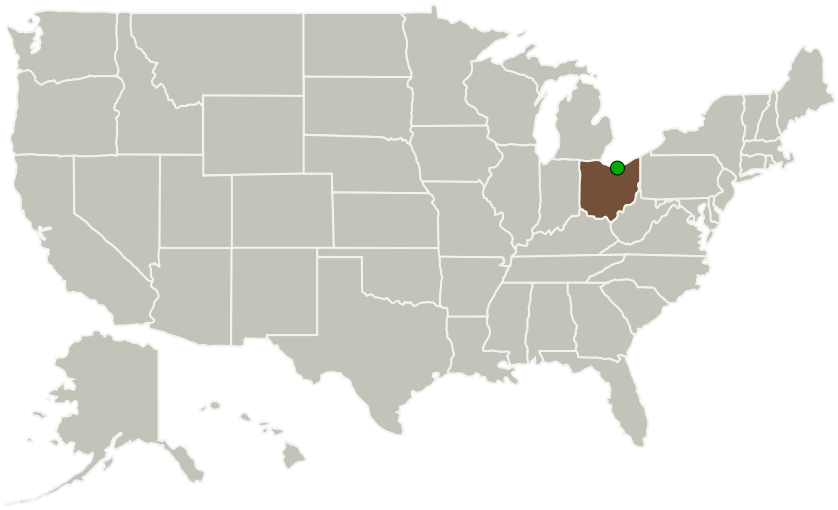
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Spectral Energies, LLC	Lead Organization	Industry Small Disadvantaged Business (SDB)	Dayton, Ohio
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations
Ohio

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141210)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Spectral Energies, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

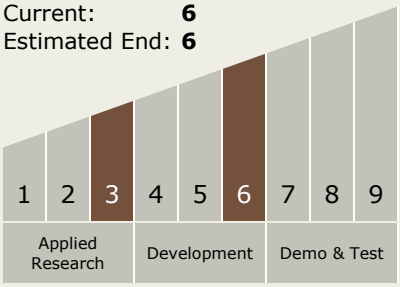
Carlos Torrez

Principal Investigator:

Christopher Ruscher

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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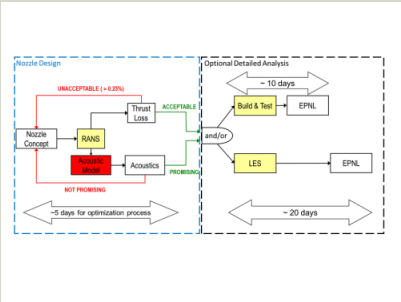
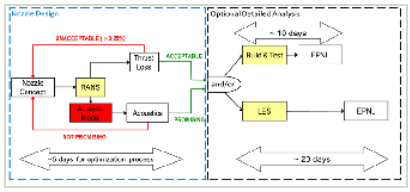
Images



Briefing Chart Image
Novel Methodology for the Rapid Acoustic Optimization of Supersonic Multi-Stream 3D Nozzles, Phase I *(https://techport.nasa.gov/image/133564)*



Final Summary Chart Image
Novel Methodology for the Rapid Acoustic Optimization of Supersonic Multi-Stream 3D Nozzles, Phase I *(https://techport.nasa.gov/image/126681)*

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics

Target Destination

Earth